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REPORT ON THE WORKSHOP ON ROAD MAINTENANCE INFORMATION SYSTEMS AND THE USE OF MICRO COMPUTERS IN MAINTENANCE

Addis Ababa (Ethiopia) 7 November 1988

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REPORT OF THE WORKSHOP ON ROAD MAINTENANCE INFORMATION SYSTEMS AND THE USE OF MICROCOMPUTERS IN MAINTENANCE
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A. ORGANIZATION

The WORKSHOP on Road Maintenance Information Systems was organized by the Economic Commission for Africa in collaboration with Roy Jorgensen Associates of the USA, a member of the International Road Federation, and the Government of the Democratic Republic of Ethiopia, was held in Addis Ababa, Ethiopia on 7 November 1988,

The Ethiopian Transport Construction Authority organized for participants a post-WORKSHOP field visit to the Highway Training Center and the Central District Maintenance Headquarters at Alemgena, on the outskirts (17 kms) of the City, on 9 November 1988.

B. ATTENDANCE

The WORKSHOP on Information Systems was attended by the following member States: Ethiopia, Egypt, Kenya, Malawi, Mozambique, Swaziland, Zambia and Zimbabwe.

Representatives of the following countries/organizations also participated at the WORKSHOP: World Bank, UNDP, UNESCO, the International Road Federation (Roy Jorgensen Associates), OAU, USSR and the USA.

C. Information Systems and Highway Maintenance

Micro-computers operating with well programmed software offer good potential for improving the effectiveness of highway maintenance management systems, through better information support for field maintenance units. Road administrations world-wide, including many in Africa, are making use of micro computers loaded with user-friendly database software to organize the status of their roads. The product would show which roads should be repaired, when they should be repaired, and how much it would cost.

In his message, Prof. Adebayo Adedeji, Under Secretary General of the United Nations and Executive Secretary of the ECA, declared that the problem of road maintenance was increasing at an alarming rate, and as roads built in the 1960s and 1970s were approaching the end of their design life, everything possible needed to be carried out by African Governments themselves, and in concert with the international community, to save the network from further destruction and deterioration. An important item on the list of activities required to improve maintenance performance was a better and more efficient information system on maintenance.

In his lecture on the use of micro-computers to manage highway maintenance, Mr.Steve Griffith said that the early computers of the 1950's were big, clumsey machines that were stationary and only knwon by a few technicians. The 1960's saw the development of more powerful systems that were easier to use. They were faster, would hold more data, which could easily be transferred from one computer to another using magnetic disks/tapes and punched cards.

In the 1970's more development provided faster and smaller computers, including the "main frame" computers which required special installation, the "mini-computers" with required smaller and minimum installation, and the micro computers which were easily transferable.

In the 1980's more development was made on faster and even smaller microcomputers: the desk top systems which can be placed in individual offices, and the lap-top systems which can be carried by hand and used in remote States..

Highway agency use of computers

Typically the use of computers has been in the following areas within a highway agency.

(i) Accounting and Administration: (Probably the first and most extensive use).

(ii) Planning and Design: computers here are used for technical calculation and for modelling; and for design and surveying applications.

(iii) Management of Highway Operation: here systems are used for scheduling of highway construction projects. (critical path methods), or multiple project scheduling. Lastly they are used for management of maintenance activities.

Using microcomputers in highway maintenance

Management of highway work is still acommplished through the same basic management principles that have been tested and used for many years for any work:

Planning
Programmingand budgeting
Scheduling and
Controlling

Although these basic concepts have changed little over the years, management application has a need to keep pace with the technology available. It is through the use of the technology of micro computers that highway managers and maintenance engineers can improve their capability to manage their maintenance work loads and programs more efficiently and effectively.

Micro computer technology has the following applications for highway maintenance:

- Survey and inventory of highway and bridges,
- Modeling of deterioration of highways and bridges,
- Preparation of annual work programme and budgets for maintenance activities,
- Scheduling of maintenance work,
- Optimizing the use of scarce resources,
- Controlling the progress and effectiveness of maintenance work,
- Storing historical data for use in determining long range plans.

In order for a micro computer to be used effectively it must have the following basic system features;

- user friendly: interactive,
- Easy to operate and maintenance,
- Menu driven,
- Micro computer application - easily transferable,
- Report generator capabilities through a suitable data base.

Use for surveying of highways and bridges

- Prepare survey form or format for data.
- Take samples of roadway and bridges or prepare 100 per cent inventory if necessary.
- Survey data could be coded on forms or input directly into lap top computers which survey crews carry with them.
- This data can then be summarized by micro computer programs and provided to managers and planners.

Modeling of deterioration of highways and bridges

Use micro computer systems to develop programs and algorithms to model the deterioration of pavement structure and bridge decks to determine when to perform major maintenance or rehabilitation.

Variables and time frames are infinte. Some basic parameters may be:

- 5, 10, 20 years time frame,
- axle loads,
- traffic volumes,
- pavement strength rating
- estimated costs of improvements.

Repeated calculations using different parameters may give guidance for optimum improvement activities.

Preparation of annual work program and budget

Inputs must be standardized to include;

- Performance standards,
- Feature inventory,
- levels of service.

Play "what if" games (modeling of activities). Variables could be;

- Level of service,
- Inventory volume,
- Performance standard values such as manpower, equipment and materials.

Prepare a work program that meets budget constraints or justify various levels of budget request.

Scheduling of maintenance activities

Once the budget has been prepared, a schedule for performing the maintenance activities can be generated.

First, the work load is leveled or adjusted to seasonal conditions. Then, a work calander can be prepared which identifies the time frame which specifies activities that should be performed. This is done for each management unit which has a budget. The result is a schedule which can be used by district personnel to schedule their maintenance activities and direct the work crews on a daily basis.

Optimizing the use of scarce resources

Based upon the annual budget and the agreed to schedule, a listing of the required resources can be developed for use by managers. These reports detail the type of worker, the type of equipment, and the types of materials required for each activity by month. Thus, managers and supervisors know well in advance what they need to perform their assigned maintenance work within their area.

Controlling the maintenance work

It should be noted that the system will not control the quality of the individual work crews. Only the supervisor can do that by inspecting the work and by training the crew.

The system will prepare the supervisor for directing the work by providing a schedule and other controlling tools. Crew day cards and work orders are printed by the computer and given by the supervisor to use in assigning specific work activities.

Completed crew day cards and work orders are returned to the supervisor at the end of each day or reporting period. This information is input into the computers data base for monitoring progress of the work. Some milestones could be as follows:

- by time,
- by activity,
- by resource,
- by cost.

This could result in reports that would help managers make decisions and control the work.

- Actual cost by maintenance activity,
- Cost per kilometer of road maintained,
- Volume of resources required and used,
- All planned versus actual activities.

Maintaining historical data

The computer system store very large amounts of data which can be used in various ways. This data can be used directly or transferred to other systems and used by people other that maintenance personnel. It provides a compact and very fast means to use large amounts of data for planning and analysis.

DISCUSSION

The discussion period provided the opportunity to examine the application and applicability of this modern technology and new knowledge in Africa, where the constraints of trained personnel, proper servicing, remote locations, high temperature and humidity, and unreliable electrical sources was weighed against low cost and mobility of personal computers and laptops, simplicity, ease of use and direct control of information systems at the district level; and to determine that micro computers were very practical indeed in maintenance management.

LIST OF PARTICIPANTS

The list of participants of the WORKSHOP in Maintenance Training Using IRF Audio Visual Materials is as follows:

A. Delegates of countries

I. EGYPT

1. Mr. Sabah El Din Husain
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   Addis Ababa

ETHIOPIA

2. Mr. Keleta Tesfa Michael, General Manager
   Ethiopian Transport Construction Authority (ETCA), Addis Ababa.

3. Commander Zewdu G/Mariam, General Manager
   Road Transport Authority of Ethiopia, Addis Ababa

4. Mr. Tedla Mulugeta, Chief Engineer, ETCA

5. Mr. Teferra Mengesha, Planning Manager, ETCA

7. Mr. Zacharia Abdulrahman, Rural Roads Co-ordinator, ETCA

8. Mr. Getahun Tsegaye, Operations Manager, ETCA

9. Mr. Tesfaye Yimer, Regional Manager, ETCA

10. Mr. Gebeyehu Mesert, District Manager, ETCA

11. Mr. Getachew Mengesha, Economist, ETCA

12. Mr. Mohammed Jemal, Statistician, ETCA

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24. Mr. V.W.Hogg, Adviser
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25. Mr. T. Wolden, Roads Maintenance Expert
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26. Mr. S. Griffith, IRF
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28 Mr. Tadesse Hailemaria, Project Manager, ETCA

29. Mr. Bogale Asfaw, Provincial Maintenance Manager, ETCA

30. Mr. Nega Wondimu, Self Help Project Manager, ETCA

31. Mr. Mulugeta Demissie, Engineer Aid IX, ETCA

32. Mr. Negede Lewi, Rural Roads STaff, ETCA

33. Mr. Getachew Worknesh, Construction Dept., ETCA

34. Mr. Yemane Shiferraw, Civil Engineer, ETCA

35. Mr. Gizaw Gulilat, District Maintenance Manager, ETCA

36. Mr. Fekadu Abayneh, District Maintenance Manager, ETCA

37. Mr. Adane Gebru, Maintenance Engineer, ETCA

38. Mr. Negash Atifre, Maintenance Technician, ETCA

39. Mr. Seifu Zunguin, Maintenance Staff, ETCA

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